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# PATENT SPECIFICATION



Application Date: Feb. 7, 1927. No. 3469 / 27.

**276,235**

Complete Accepted: Aug. 25, 1927.

## COMPLETE SPECIFICATION.

### Improvements in Vacuum Cleaners.

I, EDWIN WHITCOMB VOSE, a citizen of the United States of America, of 23, Oxford Terrace, West Orange, State of New Jersey, United States of America,  
5 do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:

10 This invention relates to vacuum cleaners, and is especially concerned with a vacuum cleaner of the hand type intended for cleaning upholstery, the interior of automobiles, stairs, draperies and the like.

It is the chief object of the invention to devise a cleaner which shall be so small and light in weight that it can be easily supported and used entirely in one hand, and at the same time shall have the necessary suction and air volume to enable it to clean quickly and thoroughly. I am aware that cleaners of this type have been proposed heretofore, but the prior machines of which I have been able to learn have not proved successful due largely to the fact that they either have been too heavy for a woman to handle, or else because they lacked the suction or 25 air handling capacity necessary to clean effectively. The present invention provides an apparatus which is not open to these objections.

The nature of the invention will be readily understood from the following description when read in connection with the accompanying drawings, and the novel features will be particularly pointed out in the appended claims.

40 Referring now to the drawings,

Figure 1 is a plan view, partly in cross section, showing a cleaner embodying this invention;

Fig. 2 is a side elevation of the cleaner shown in Fig. 1;

Fig. 3 is a perspective view showing one method of using the cleaner;

Fig. 4 is an end view of the nozzle and

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casing construction of the cleaner shown in Figs. 1 and 2;

50 Fig. 5 is a front elevation of the fan used in the cleaner shown in Figs. 1 and 2;

Fig. 6 is a side elevation showing the method of using the cleaner on rugs and the like; and

55 Fig. 7 is a front elevation of a part of an auxiliary handle which may be used with the cleaner.

Referring first to Figs. 1 and 2; the construction there shown comprises an electric motor 2 which preferably is of a light weight high speed type adapted to run at about 10,000 or 12,000 revolutions per minute.

60 Secured on the shaft 3 of this motor is a fan 4 of novel construction. This fan is of approximately conical form and comprises a hollow body 5 of conical shape provided with a central hub and having a series of spiral blades 6 projecting from its outer surface, as best shown in Figs. 1 and 5. Both the motor and the fan are enclosed in a casing which comprises a central body portion 7 of approximately cylindrical form with tapered end sections 8 and 9, respectively, at opposite ends of said body portion. The forward tapered section 8 closely encircles the fan 4, only a comfortable running clearance being provided between this section and the fan. A nozzle 10 is secured to the intake end of the casing section 8. This nozzle turns or bends abruptly away from the intake opening and extends downwardly, terminating in an open mouth adapted to rest on the carpet, rug, or other surface to be cleaned.

65 The motor is spaced from the inner wall of the casing by a series, preferably three, of plates 12, the inner edges of these plates being bolted or riveted to the motor frame or housing, while their outer edges are secured, as by bolts 13, to the body portion 7 of the casing. For

convenience in assembling the parts and also in order to permit access to the interior of the casing, I prefer to make the tapered section 8 removable from the body section 7, and for this purpose the part 8 is provided with three pins or lugs 14, Figs. 1 and 4, which fit into bayonet slots or grooves 15 formed in the body section 7. Another pin 16, Fig. 4, mounted on the end of a spring 17, Fig. 2, which is riveted to the part 7, normally fits in a hole in the section 8 and prevents the relative rotation of the casing sections 7 and 8 which is necessary to release the lugs 14 from the bayonet slots. By springing the pin 16 out of its hole, the casing member 8 may be rotated far enough to free the pins 14 from the bayonet slots.

When the motor 2 is running it revolves the fan 4 at a high speed and the current of air created by this fan is forced backwardly around the motor 2 and flows through the space between the motor housing and the casing 7, thence through the tapered section 9, and finally through a discharge tube 18 into a bag or dust catcher 19.

The tube 18 is rigidly secured to the casing section 9, and it performs both the functions of a discharge tube and also of a handle. The rearward end of this tube is enlarged or flanged, as shown at 20, and the mouth of the bag may be conveniently fastened to this tube by a draw string 21.

Attention is particularly directed to the construction of the fan and its relationship to the adjacent parts of the apparatus. When this fan is driven rapidly by the motor the inclined blades 6 force the air both backwardly and also outwardly away from the axis of the fan, the fan in this respect combining the functions of both the centrifugal and propeller types. At the same time the fact that this fan is closely encircled by the tapered casing section 8 enables it to exert an unusually positive action on the air, and hence produces a relatively high vacuum and handles a big volume of air. The body 5 of the fan preferably is tapered at an angle of approximately  $45^{\circ}$ , and the end of the motor housing projects into and is overlapped and closely encircled by this body so that the end of the motor lies within the path of revolution of the blades 8. This arrangement is of advantage in producing a compact construction; preventing the entrance of hair, threads, or the like, into the space around the forward end of the motor shaft; and also reduces the air friction on the motor frame or housing. It should also be noted that the rearward ends of the blades 6 extend backwardly substantially to the rearward edge of the body 5 and terminate just in front of the baffle plates 12, a running clearance only being provided between the blades 6 and the plates 12. These baffle plates perform the double function of supporting the motor 2 in its spaced position inside the casing 7, and also of dividing the air space between the motor and the casing into a series of air channels that extend longitudinally of the motor and prevent rotation of the air around the motor. If it were not for these plates the effectiveness of the fan would be partially lost in circumferential rotation of the air inside the casing. The baffle plates, however, prevent such rotation, direct the air backwardly, and are especially useful in preventing sand, pins and other heavy material from circulating within the casing and resisting ejection by the air currents.

The tendency of the air to eddy around the rearward end of the motor is prevented by securing a shell 22, Fig. 1, over the rearward end of the motor where it forms part of the housing for the motor; the rearward end of this shell being of conical form, as clearly shown in the drawings, so that its surfaces are substantially parallel to the inner wall of the rearward section 9 of the casing. The taper of this section, also, like that of the section 8, preferably is not greater than  $45^{\circ}$  so that a smooth, easy path is provided through the entire casing for the flow of the air, sharp turns in the air stream are avoided and frictional losses are reduced. I prefer to make the motor housing as tight as possible so that it will be dust proof. The motor is effectively cooled by the stream of air which is flowing past it in contact with the motor housing.

It will be observed that this entire construction is of very light weight, the casing and housing members preferably being of sheet metal construction, and the fan 4 being made either by pressed metal operations and the proper assembly, or by a die casting of light weight. The bag or dust catcher 19 may be made of a fleeced fabric of which such bags are commonly made. The electrical conductors 24 leading to the motor 2 are preferably brought into the motor housing through a bushing 25, Fig. 2, a coiled spring guard 26 being secured to the part 9 to protect the conductor.

While the motor used may be of any suitable type, the motor shown has unique features. It is of the so-called "universal" type, that is, designed to run on either alternating or direct cur-

- rent. Instead of using the usual cast metal housing I have provided a housing of sheet metal comprising two members 35 and 36, Fig. 1, which are secured together by bolts, one of which is shown at 37. The bolts clamp the two housing sections to the field. The outside housing section 22 telescopes over the parts 35 and 36. The bearings 38 and 39 for the motor shaft are mounted in the respective housing sections 36 and 35. These bearings may be of any suitable type, but, as shown, consist simply of bushings. Since the motor runs at a relatively high speed, it is desirable to select the bearings with some care, and I have obtained good results by using self-lubricating bushings, and also by using ball bearings.
- It is contemplated that in using the cleaner for most purposes the entire apparatus will be held in and manipulated by the hand, as shown in Fig. 3, the tube 18 being utilized as a handle, and the dust bag 19 being supported on the arm of the user by means of a loop 27 which is connected to the bag. This is the manner in which the cleaner is used, for example, in cleaning draperies, upholstery, stair carpets, mattresses, the interior of automobiles, and the like. The cleaner may, however, be used for cleaning rugs or carpets, and for this purpose I prefer to attach a caster or roll 28 to the casing section 9, as best shown in Figs. 2, 3 and 6. A small U-shaped bracket 29 is also riveted to the upper side of this casing section, and the two legs of this bracket have holes formed therethrough, one of which is shown at 30, Fig. 2, to receive the wire ends 30, Fig. 7, projecting from a long handle 32. The ends 31 tend to spring apart and they snap into the holes 30 in the bracket 29. This handle is provided with a clip 33, Fig. 6, to receive the loop 27 or supporting the bag, and with another clip 34 holds the cord or electrical conductor 24. When equipped with this long handle, as shown in Fig. 6, the cleaner may be used as a sweeper in a manner similar to that in which the ordinary commercial types of cleaners are used.
- The cleaner provided by this invention, therefore, is capable of an unusually wide variety of use. It has proved in practice to be so light in weight that it can easily be handled by a woman while using it in the manner shown in Fig. 3, and it has a very high suction for a fan type of cleaner as well as an uncommonly high air handling capacity. It therefore cleans very quickly and thoroughly. The design also is such that the cleaner can be manufactured economically. Obviously the apparatus can be used as a blower by removing the dust catcher or bag.
- While I have herein shown and described the best embodiment of my invention that I have so far devised, it will be evident that the invention may be embodied in other forms without departing from the spirit or scope thereof.
- Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:
1. A vacuum cleaner in which the suction is caused by a fan driven by an electric motor, both of which are enclosed within a casing spaced from the motor so as to provide a passage around said motor for the flow of air backwardly from the fan, characterized in that the blades of the fan are confined within a space adjacent one end of the motor which is defined by outer and inner walls of substantially conical form.
  2. A vacuum cleaner as claimed in Claim 1 or 2, characterized in that means are provided within the space around the motor between the motor and the casing for preventing circumferential rotation of air in said space as it flows past the motor.
  3. A vacuum cleaner as claimed in any of the preceding claims, characterized in that said fan is of the combined centrifugal and propulsion type.
  4. A vacuum cleaner as claimed in any of the preceding claims, characterized in that the fan driven by the motor comprises a hollow body of approximately conical form with spiral blades projecting therefrom, such conical body forming the inner wall of the space in which the blades of the fan are confined.
  5. A vacuum cleaner as claimed in Claim 4, characterized in that the outer wall of the space of substantially conical form in which the fan rotates comprises a tapered section forming one end of the casing, such tapered section being connected to a central body portion of the casing.
  6. A vacuum cleaner as claimed in Claim 4 or 5, characterized in that one end of said motor is positioned within the path of revolution of the blades of said fan and is closely encircled thereby.
  7. A vacuum cleaner as claimed in Claim 5 in which the casing enclosing the motor and fan has a section at the rear end thereof communicating with a nozzle to which the dust catcher is adapted to be connected, characterized in that said section is of conical form.

8. A vacuum cleaner as claimed in Claim 5 and any of the preceding claims, characterized in that the section of the casing encircling the fan is adapted to be detachably connected to the body portion of the casing so that such portions may be readily disconnected.
9. A vacuum cleaner as claimed in Claim 4, and in any of the preceding 10 claims, characterized in that the hollow body of the fan is adapted to cooperate with the motor so as to prevent foreign material carried by the air stream from lodging between said fan and motor.
10. A vacuum cleaner as claimed in Claim 9, characterized in that the rearward edge of said fan body closely encircles the forward part of the motor.
11. A vacuum cleaner as claimed in any of the preceding claims, characterized in that the discharge nozzle projecting from the rear end of the casing forms a discharge tube to which the dust catcher is adapted to be fastened.
12. A vacuum cleaner as claimed in 25 Claim 11, characterized in that said discharge tube is in the form of a hollow handle which is adapted to be gripped by the hand of the operator.
13. A vacuum cleaner substantially as 30 described with reference to the accompanying drawings.

Dated this 7th day of February, 1927.

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8. A vacuum cleaner as claimed in Claim 5 and any of the preceding claims, characterized in that the section of the casing encircling the fan is adapted to be detachably connected to the body portion of the casing so that such portions may be readily disconnected.
9. A vacuum cleaner as claimed in Claim 4, and in any of the preceding claims, characterized in that the hollow body of the fan is adapted to cooperate with the motor so as to prevent foreign material carried by the air stream from lodging between said fan and motor.
10. A vacuum cleaner as claimed in Claim 9, characterized in that the rearward edge of said fan body closely encircles the forward part of the motor.
11. A vacuum cleaner as claimed in any of the preceding claims, characterized in that the discharge nozzle projecting from the rear end of the casing forms a discharge tube to which the dust catcher is adapted to be fastened.
12. A vacuum cleaner as claimed in Claim 11, characterized in that said discharge tube is in the form of a hollow handle which is adapted to be gripped by the hand of the operator.
13. A vacuum cleaner substantially as described with reference to the accompanying drawings.

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Fig. 1.

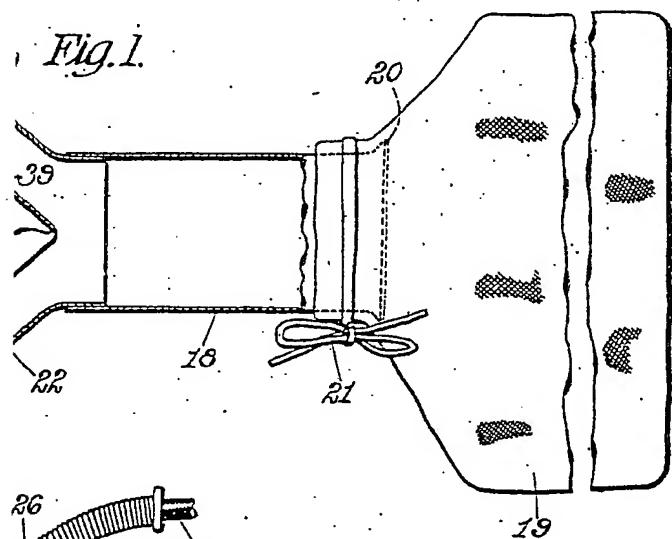


Fig. 4.

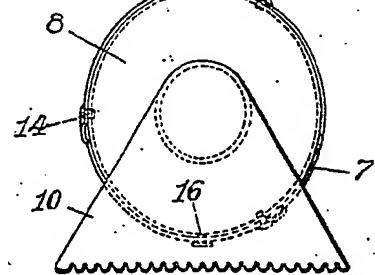


Fig. 5.

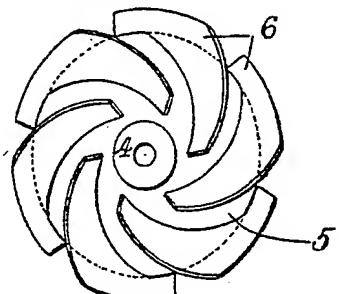


Fig. 3.

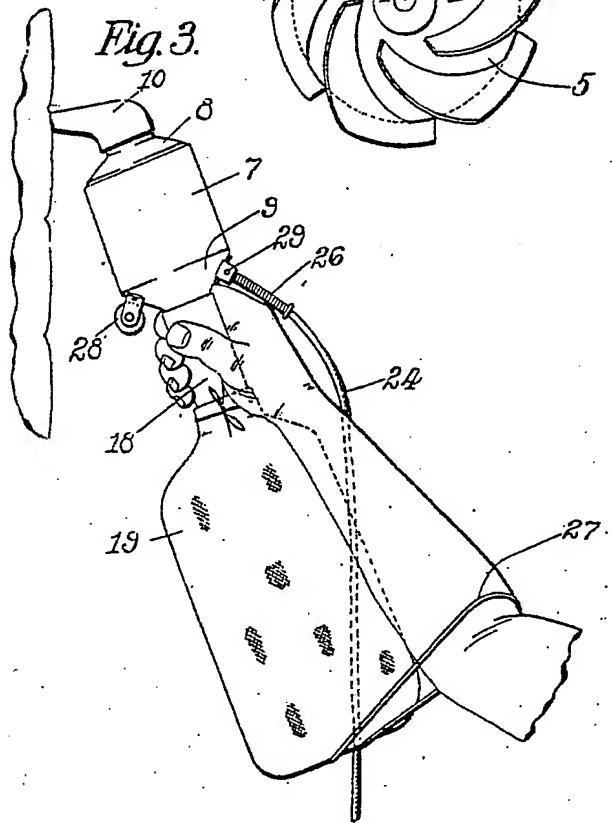
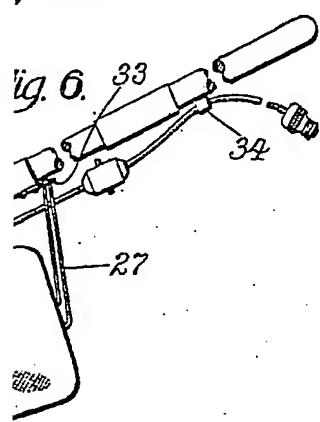
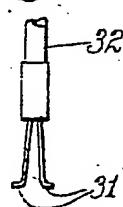
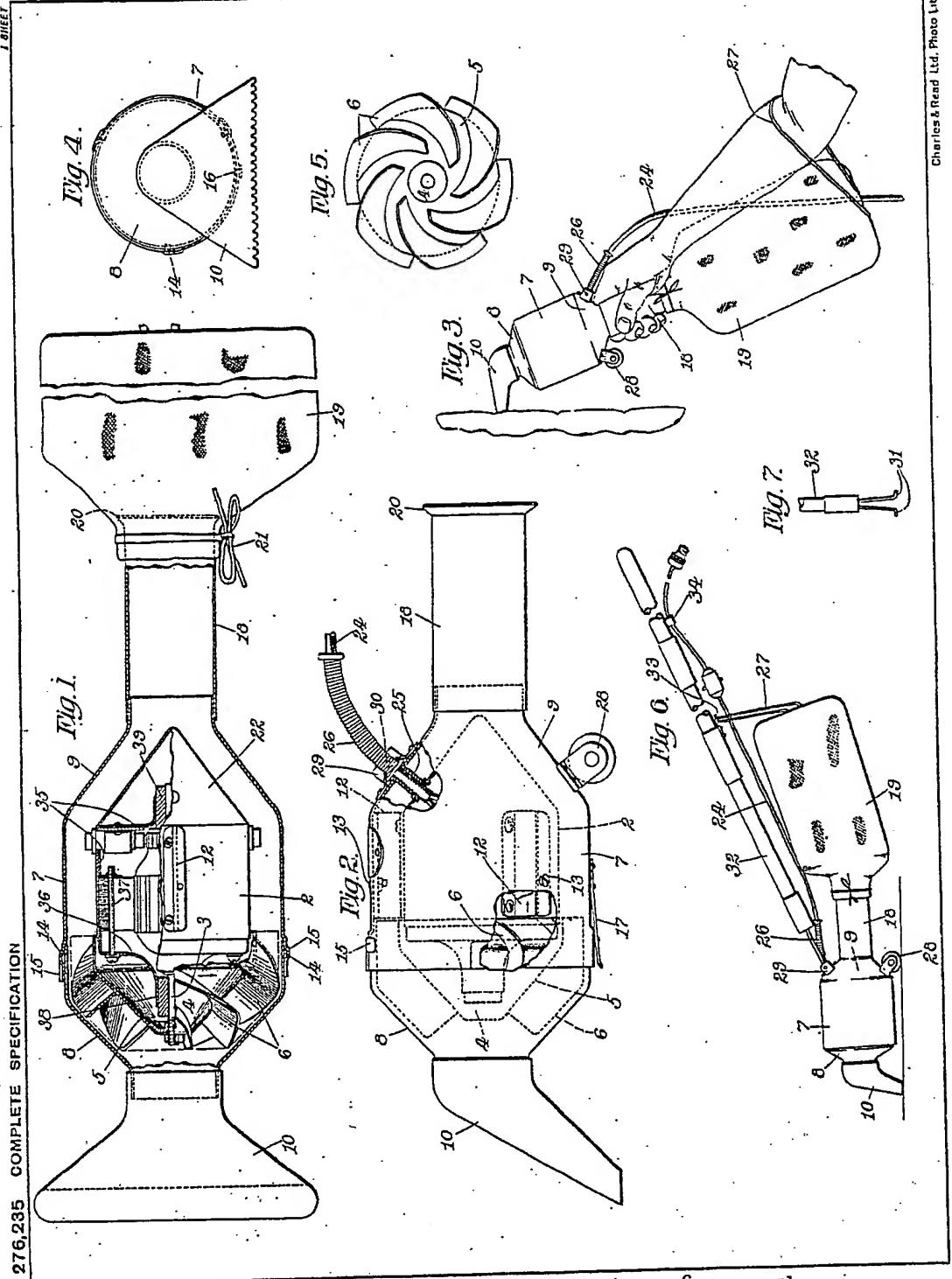


Fig. 7.



276,285 COMPLETE SPECIFICATION



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